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GRAIN SORGHUM SEED

By ERNEST B. BABCOCK



Fig. 1.—Dwarf milo; right, an excellent head—erect, compact, well-filled; left, a poor head—crook-necked and loose although large and well-filled.

The grain sorghums as commonly grown in California are exceedingly variable. This is especially marked in the case of Milo, which is the most extensively cultivated variety. For example, most fields of Milo consist of a mixture of tall, medium, and short plants, and such fields cannot be harvested by machinery. In order to harvest with a header it is necessary that the field be fairly uniform in height. The plants in an ordinary field of grain sorghum also differ greatly in yield, some producing a single, large, well filled head, while others bear two or more small or poorly filled heads. The maximum yield will be obtained by growing the largest practicable number of single-stalked plants and the crop can be harvested most economically if the plants are of uniform, medium height.

The cost of selecting better seed is very small, but the results of growing crops from such seed may be surprisingly valuable. The actual work of seed selection can be done by boys if necessary, as has been demonstrated by the boys' clubs (see fig. 2). Success with seed selection depends upon knowing how. It is the purpose of this circular to present simple, definite directions for selection of grain sorghum seed. In order that the reasons for these directions may be understood, the principles and methods of seed selection will be briefly discussed.

PRINCIPLES AND METHODS

Selection will bring results with any crop, but the results obtained will depend mainly on two factors; first, the manner of reproduction in each kind of plant; second, the method of selection used. As regards the first factor, plants are either self-fertilized, in which case the male and female elements come from the same plant or even the same flower, or they are cross-fertilized, in which case the male and female elements come from two plants. Wheat, barley, rice, and beans are described as close-fertilized, which means they are not only self-fertilized, but that each flower fertilizes itself. Only rarely do the flowers on these plants open in such a way as to permit of crossing with other plants. Therefore, as commercial varieties contain plants which differ inherently, it is possible to isolate different strains from such varieties by the single act of gathering seed from individual plants, provided the seed from each plant is sown separately. In sorghum, corn, cotton, and melons, however, this cannot be done so easily, for these plants are naturally cross-fertilized to a greater or less extent, and the seed from a single plant under field conditions is more or less likely to be of mixed ancestry, and hence to produce mixed progeny. For this reason, as a general rule, different varieties of these and other cross-fertilized plants intended for use as seed should not be planted near each other. The result of such planting is an undesirable mixture difficult to handle satisfactorily and often less productive than either parent. The important factor determining the effectiveness of seed selection is the method used. For the present emergency there are three practicable methods: (1) the choosing of good fields for seed; (2) roguing seed fields; (3) selecting the best plants for next year's seed. These methods will be considered

with special reference to grain sorghums. The following remarks are by way of introduction.

1. Many of the "standard" varieties of sorghum have become badly mixed. This reduces the uniformity of the crop and may decrease the yield. Another important consideration is the fact that localities differ more or less in soil and climate, and in each commercial variety there may be strains which are better adapted to your locality than are other strains of the same variety. This will certainly be found in the case of such strikingly different regions as the Imperial Valley and the northern coast counties, but it also holds for less distinct localities. This is a good reason for encouraging seed selection in every agricultural district of the state. Of equal im-



Fig. 2.—By the selection of heads of uniform height and of the desired type, in the field before harvest, for two years, this boy secured this uniform field of dwarf milo the third year. The yield is estimated at 5000 pounds of grain per acre, while the present average yield per acre for California is 1800 pounds.

portance is the use of well cleaned and carefully graded seed. The practical value of planting large, plump seeds, free of weeds, is very great. It must be admitted that the finest fields of a given variety are usually owned by those who practice the best methods of culture or who are specially fortunate as regards soil, time of planting, etc. Hence in selecting the finest single field in a certain locality for seed we do not *know* that this seed is inherently superior to seed from neighboring fields. It is a safe risk, however, to assume that it is equally good and there are some chances that the best fields contain a large proportion of superior strains. Production in 1918, therefore, can be increased by choosing superior fields of single varieties and giving special attention to cleaning and preserving the seed. Considerable care should be given to selecting such fields.

2. Roguing is a supplementary effort to insure the purity and

uniformity of the variety. It consists in pulling or chopping all plants of other varieties or types so as to reduce contamination of the stock. As practiced by progressive seed growers it is an indispensable part of the programme followed in producing high grade seed. In this work not only are plants of other varieties eliminated but a definite type is maintained so far as practicable. Even if no roguing can be done this year, the careful selection of fields for the local supply of next year's seed is urged upon every farming community and agricultural organization in the state.

3. The other method will probably appeal most to individual growers, although there is no reason why it should not become part of a community project, provided the work is put in charge of re-



Fig. 3.—This boy selected heads of grain for seed after the entire crop had been harvested and thrown in a pile. Note the nonuniformity in the height of the heads. To harvest this field will require almost as much time as will be required for the properly selected field, although the yield will be only slightly above average.

sponsible parties. Selecting the best plants for bulk seed can be done easily by any grower if he will confine his attention to a very few essential points. The first consideration will usually be yield, but often there is some other point equally important; for example, in sorghum it is height of plant; in cotton, length of staple; in potatoes, number of marketable tubers, etc. By going through the field before harvesting, seed for the next crop can be gathered from selected plants with but little extra trouble. The results secured will usually repay for this trouble many times over.

FIELD SELECTION

Choosing Seed Fields.—There are several distinct kinds of grain sorghums and they cross readily with each other. For this reason some fields of sorghum are so much mixed that it is hardly worth

while to practice seed selection. On the other hand, some growers have already practiced selection of sorghum seed and efforts should be made to locate such sources of superior seed. Farm Bureaus and other agencies looking for stocks of grain sorghum seed should consider only fields composed of a single variety. As a rule it is wise to choose the variety that has proven most successful locally. Starting with such a field, provided it is separated by a distance of 100 yards or more from other varieties, there is no question that selected and graded seed will give much better results than the unselected crop from the same field.



Fig. 4.—Dwarf milo; right, an ideal plant—medium height, single stalk, no ratoons, head erect, free from boot, compact and well-filled; left, a very poor plant—too tall, with suckers and ratoons, crook-necked.

Selecting Seed from Chosen Fields.—Seed for the 1918 crop should be gathered before the main crop is harvested. This can be done by driving a double wagon (or a single horse and sled) up and down the field while several men or boys, each working on one or two rows, select and cut the heads and throw them into the wagon. These men should be given definite instructions according to the variety. In general aim at two things, viz., *high yield* and *uniform height*. To get high yield pick the largest, most compact, well filled heads. An excellent plant of dwarf milo is shown on the right in fig. 4 and, on the left, a plant which is undesirable in every feature. An ideal head and a very poor head are shown in fig. 1. To get more uniformity in height select only from plants of medium growth, avoiding both the very short and very tall plants. Any workman of ordinary intelligence can follow these directions and there is no question that seed selected according to this simple plan will produce better results than

ordinary unselected seed. The greater the care used in selecting individual plants the more valuable the results, provided proper standards are observed. The following score card prepared by Hendry gives definite directions regarding each of the important points to be considered.

SCORE CARD FOR GRAIN SORGHUMS

| | Perfect score |
|--|---------------|
| 1. Earliness | 15 |
| 2. Erectness of head | 5 |
| 3. Size, weight, and compactness of head | 20 |
| 4. Freedom of head from boot | 5 |
| 5. Freedom from suckers or branches | 5 |
| 6. Resistance to lodging | 5 |
| 7. Height of stalk | 5 |
| 8. Firmness of stalk | 5 |
| 9. Juiciness of stalk | 5 |
| 10. Abundance of leaves | 10 |
| 11. Greenness of leaves late in season | 5 |
| 12. Purity | 15 |
| Total | 100 |

EXPLANATION OF TERMS

1. *Earliness*.—Early maturity means drouth evasion. Under middle Sacramento Valley conditions the Duras should ripen in from 90 to 110 days.

2. *Erectness of Head*.—Goose-necks interfere with machine harvesting, shocking, and feeding, and should be discriminated against. If slightly inclined or nodding, cut less severely.

3. *Size, Weight, and Compactness of Head*.—Large, well filled heads mean large yields and this point should be given precedence over all other characters. A good head with a two-inch stem should consist of 85 per cent grain by weight.

4. *Freedom of Head from Boot*.—Heads which do not clear the boot completely do not mature uniformly, are apt to be off color, and damaged by insects.

5. *Freedom from Suckers or Branches*.—Plants which are free from suckers and lateral branches (or ratoons), are more uniform in height and ripening, and are therefore more desirable.

6. *Resistance to Lodging*.—Even though a plant is good in other respects, if it shows a tendency to lodge it should not be selected for seed.

7. *Height of Stalk*.—Excessive height makes cutting by hand difficult and heading by machinery almost impossible. Plants of short stature also have lower water requirements.

8 and 9. *Fineness and Succulence of Stalk*.—Small juicy stalks are preferable to coarse, pithy ones and should be given preference in selection.

10 and 11. *Abundance of leaves*, especially if they retain their greenness and succulence late in the season, is a factor in determining the fodder value of the plant.

12. *Purity*.—Sweet sorghum, broom corn, and Sudan grass mix readily, and the hybrid plants can usually be distinguished by their vigor, coarseness, or late maturity. Since they do not breed true they should not be selected for seed.

Preserving the Seed.—Dry the selected heads on trays, turning from tray to tray every three or four days; or spread on the ground and turn with a fork if necessary to insure thorough drying. This drying is absolutely essential as heating is certain to occur when the heads are stored while still moist. When thoroughly dry the heads

may be preserved by placing them loosely in grain sacks and hanging the sacks in a dry place. By suspending the sacks with wire the loss from mice will be reduced. If necessary the heads can be threshed at once and stored in a dry place, but if this is done the individual heads cannot be tested for germination. It is better to thresh by hand as there is less danger of injuring the seed in such a way as to prevent germination.

Testing for Germinating Power.—It is important to know that the seed to be planted will germinate well. Some heads produce seed of lower germinating power and the use of such seed causes poor stands of sorghum. By using seed known by test to have germinating power less seed per acre will be needed to insure a good stand than with



Fig. 5.—Good yields of grain can not be secured when the crop is planted too thickly and sufficient moisture is not available. The above picture illustrates the interplanting of five rows of grain between trees in a young orchard. The two outside rows gave a fair crop of heads, while the center row did not give a single head, and the two intermediate rows only a few heads. More grain would have been secured had only three rows been planted, or the five rows thinned out considerably.

unselected seed. A simple method of testing is to fill a box nearly full of thoroughly moist soil or sand, level the surface, and mark it off into squares about two inches in diameter. Mark one corner so it will be possible to count in regular order to any check. In each square punch nine holes about half an inch deep, three rows of three holes each, near the center of the square. Lay out the heads to be tested in a row where they will not be disturbed for a few days. Starting at one end of the row take up each head in order and pick off nine kernels from different parts of the head. Place these in the nine holes in square No. 1 and cover firmly with soil. After kernels from each head have been planted set the box in a warm place. The seed should sprout in a few days if kept sufficiently warm. No heads

should be used that give less than seven sprouted seeds. Heads producing weak or sickly seedlings should be discarded.

Roguing the Field.—In fields that have not yet headed out it will pay to rogue the field, or that portion of it from which seed is to be selected. This should be done about a week before the earliest plants begin to bloom. The object of roguing is to remove all off-type plants so as to prevent the crossing of these plants with the plants to be selected later. At this stage plants that are too tall can be detected as easily as when the crop is mature, also weak or diseased plants, etc. If it is too late to rogue this year, it should become the preliminary step to seed selection in 1918 and succeeding years.



Fig. 6.—The desirable heads may be cut before harvest and thrown into a wagon driven through the field. About twelve heads of grain will plant an acre.

TESTING INDIVIDUAL PLANTS TO IMPROVE STRAINS

This is a more effective method of improving the crop than field selection as above described, and it will pay the grower to practice it. By continually selecting seed from individual plants you are controlling half of the ancestry of your crop. It is something like grading a herd by the use of a pure bred bull. In this work the standard of selection may include other points besides yield and height of plant, such as season of bloom, drouth and disease resistance, etc. The plant-to-row method should be used, each head being planted in a row by itself. Only the best rows for all points considered should be retained for the improved strain, the remainder being used for next year's crop. The superior rows should be carefully rogued and the seed planted in an increase plot the following year and rogued again. The third year there will be sufficient of this superior seed for a large acreage and it should be worth considerably more than ordinary seed.